WHAT IS CLAIMED IS:

1. An exchange coupled film comprising:

a nonmagnetic seed layer comprising α and Cr, α being at least one of Fe, Ni, and Co;

an antiferromagnetic layer; and

a ferromagnetic layer,

the seed layer, the antiferromagnetic layer, and the ferromagnetic layer being deposited in that order from the bottom, the magnetization of the ferromagnetic layer being directed in a predetermined direction by an exchange coupling magnetic field produced at the interface between the antiferromagnetic layer and the ferromagnetic layer,

wherein the Cr content of the seed layer is 35 to 60 atomic percent, the thickness of the seed layer is 10 to 200 Å, and the crystal structure of the seed layer is a face-centered cubic structure.

2. An exchange coupled film according to Claim 1, wherein the Cr content is 40 to 60 atomic percent, and the thickness of the seed layer is 10 to 170 Å.

3. An exchange coupled film according to Claim 1, wherein the Cr content is 45 to 60 atomic percent, and the thickness of the seed layer is 10 to 130 Å.

4. An exchange coupled film according to Claim 1,

wherein the Cr content is 40 to 50 atomic percent, and the thickness of the seed layer is 10 to 170 Å.

5. An exchange coupled film according to Claim 1, wherein the Cr content is 45 to 55 atomic percent, and the thickness of the seed layer is 10 to 130 Å.

6. An exchange coupled film according to Claim 1, wherein the thickness of the seed layer is 80 Å or less.

7. An exchange coupled film according to Claim 1, wherein the thickness of the seed layer is 60 Å or less.

8. An exchange coupled film according to Claim 1, wherein the seed layer comprises one of a NiFeCr alloy and a NiCr alloy.

9. An exchange coupled film according to Claim 8, wherein the seed layer has a composition represented by $(Ni_{100-x}Fe_x)$-Cr, and the atomic ratio x satisfies the relationship $0 \leq x \leq 70$.

10. An exchange coupled film according to Claim 9, wherein the atomic ratio x satisfies the relationship $0 \leq x \leq 50$.

11. An exchange coupled film according to Claim 10,

wherein the atomic ratio x satisfies the relationship $0 \leq x \leq 30$.

12. An exchange coupled film according to Claim 1, further comprising an underlayer formed under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

13. An exchange coupled film according to Claim 1, wherein the seed layer is formed by sputtering.

14. An exchange coupled film according to Claim 1, wherein the average crystal grain size in a direction parallel to the layer surface in each layer formed on the seed layer is 100 Å or more.

15. An exchange coupled film according to Claim 14, wherein the average crystal grain size is 150 Å or more.

16. An exchange coupled film according to Claim 14, wherein the average crystal grain size is 170 Å or more.

17. An exchange coupled film according to Claim 1, wherein the grain boundaries formed in the antiferromagnetic layer and the grain boundaries formed in the ferromagnetic layer which appear in a cross section of the exchange coupled film parallel to the thickness direction are at

least partially discontinuous at the interface between the antiferromagnetic layer and the ferromagnetic layer.

18. An exchange coupled film according to Claim 1, wherein the grain boundaries formed in the antiferromagnetic layer and the grain boundaries formed in the seed layer which appear in a cross section of the exchange coupled film parallel to the thickness direction are at least partially discontinuous at the interface between the antiferromagnetic layer and the seed layer.

19. An exchange coupled film according to Claim 1, wherein equivalent crystal planes represented as {111} planes in the antiferromagnetic layer and the ferromagnetic layer are preferentially oriented as crystal planes parallel to the interface between the antiferromagnetic layer and the ferromagnetic layer, and at least some of the equivalent crystal axes in the crystal planes are directed in different directions between the antiferromagnetic layer and the ferromagnetic layer.

20. An exchange coupled film according to Claim 1, wherein equivalent crystal planes represented as {111} planes in the antiferromagnetic layer and the seed layer are preferentially oriented as crystal planes parallel to the interface between the antiferromagnetic layer and the seed layer, and at least some of the equivalent crystal axes in

the crystal planes are directed in different directions between the antiferromagnetic layer and the seed layer.

21. An exchange coupled film according to Claim 1, wherein the antiferromagnetic layer comprises X and Mn, wherein X is at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, and Os.

22. An exchange coupled film according to Claim 1, wherein the antiferromagnetic layer comprises an X-Mn-X' alloy, wherein X is at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, and Os and X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Ir, Sn, Hf, Ta, W, Re, Au, Pb, and rare-earth elements.

23. An exchange coupled film according to Claim 22, wherein the X-Mn-X' alloy is either an interstitial solid solution in which atoms of X' enter interstices in a space lattice comprising X and Mn or a substitutional solid solution in which atoms of X' are substituted for some atoms at the lattice points of a crystal lattice comprising X and Mn.

24. An exchange coupled film according to Claim 21, wherein the X content is 45 to 60 atomic percent.

25. An exchange coupled film according to Claim 22, wherein the X + X' content is 45 to 60 atomic percent.

26. An exchange coupled film comprising:

a nonmagnetic or partially ferromagnetic seed layer comprising α and Cr, α being at least one of Fe, Ni, and Co;

an antiferromagnetic layer; and

a ferromagnetic layer,

the seed layer, the antiferromagnetic layer, and the ferromagnetic layer being deposited in that order from the bottom, the magnetization of the ferromagnetic layer being directed in a predetermined direction by an exchange coupling magnetic field produced at the interface between the antiferromagnetic layer and the ferromagnetic layer,

wherein the Cr content of the seed layer at the interface with the antiferromagnetic layer is 40 atomic percent or more and is higher than the Cr content at another surface of the seed layer opposite to the antiferromagnetic layer, the seed layer has a region in which the Cr content gradually increases toward the antiferromagnetic layer, and the crystal structure of the seed layer at the interface with the antiferromagnetic layer is a face-centered cubic structure.

27. An exchange coupled film according to Claim 26, wherein the Cr content of the seed layer at the interface

with the antiferromagnetic layer is 40 to 70 atomic percent.

28. An exchange coupled film according to Claim 27, wherein the Cr content is 45 to 60 atomic percent.

29. An exchange coupled film according to Claim 26, wherein the Cr content of the seed layer at the surface opposite to the antiferromagnetic layer is 20 to 45 atomic percent.

30. An exchange coupled film according to Claim 29, wherein the Cr content is 20 to 40 atomic percent.

31. An exchange coupled film according to Claim 26, wherein the seed layer comprises one of a NiFeCr alloy and a NiCr alloy.

32. An exchange coupled film according to Claim 31, wherein the seed layer has a composition represented by $(Ni_{100-x}Fe_x)$-Cr, and the atomic ratio x satisfies the relationship $0 \leq x \leq 70$.

33. An exchange coupled film according to Claim 32, wherein the atomic ratio x satisfies the relationship $0 \leq x \leq 50$.

34. An exchange coupled film according to Claim 33,

wherein the atomic ratio x satisfies the relationship $0 \leq x \leq 30$.

35. An exchange coupled film according to Claim 26, wherein the thickness of the seed layer is 23 to 80 Å.

36. An exchange coupled film according to Claim 35, wherein the thickness of the seed layer is 25 to 50 Å.

37. An exchange coupled film comprising:

a nonmagnetic or partially ferromagnetic seed layer;

an antiferromagnetic layer; and

a ferromagnetic layer,

the seed layer, the antiferromagnetic layer, and the ferromagnetic layer being deposited in that order from the bottom, the magnetization of the ferromagnetic layer being directed in a predetermined direction by an exchange coupling magnetic field produced at the interface between the antiferromagnetic layer and the ferromagnetic layer,

wherein the seed layer has a layered structure comprising a nonmagnetic or partially ferromagnetic upper sublayer and a nonmagnetic or partially ferromagnetic lower sublayer, each comprising α and Cr, α being at least one of Fe, Ni, and Co,

wherein the Cr content of the upper sublayer is 40 atomic percent or more, and the crystal structure at the interface with the antiferromagnetic layer is a face-

centered cubic structure,

wherein the Cr content of the upper sublayer is higher than the Cr content of the lower sublayer, and the thickness of the upper sublayer is smaller than the thickness of the lower sublayer.

38. An exchange coupled film according to Claim 37, wherein the Cr content of the upper sublayer is 40 to 70 atomic percent.

39. An exchange coupled film according to Claim 38, wherein the Cr content of the upper sublayer is 45 to 60 atomic percent.

40. An exchange coupled film according to Claim 37, wherein the Cr content of the lower sublayer is 20 to 45 atomic percent.

41. An exchange coupled film according to Claim 40, wherein the Cr content of the lower sublayer is 20 to 40 atomic percent.

42. An exchange coupled film according to Claim 37, wherein each of the upper sublayer and the lower sublayer comprises one of a NiFeCr alloy or a NiCr alloy.

43. An exchange coupled film according to Claim 37,

wherein each of the upper sublayer and the lower sublayer has a composition represented by $(Ni_{100-x}Fe_x)$-Cr, and the atomic ratio x satisfies the relationship $0 \leq x \leq 70$.

44. An exchange coupled film according to Claim 43, wherein the atomic ratio x satisfies the relationship $0 \leq x \leq 50$.

45. An exchange coupled film according to Claim 44, wherein the atomic ratio x satisfies the relationship $0 \leq x \leq 30$.

46. An exchange coupled film according to Claim 37, wherein the lower sublayer comprises a NiFe alloy.

47. An exchange coupled film according to Claim 37, wherein the thickness of the upper sublayer is 3 to 20 Å.

48. An exchange coupled film according to Claim 47, wherein the thickness of the upper sublayer is 5 to 10 Å.

49. An exchange coupled film according to Claim 37, wherein the thickness of the lower sublayer is 20 to 60 Å.

50. An exchange coupled film according to Claim 49, wherein the thickness of the lower sublayer is 20 to 40 Å.

51. An exchange coupled film according to Claim 37, wherein the seed layer further comprises at least one nonmagnetic or partially ferromagnetic intermediate sublayer formed between the upper sublayer and the lower sublayer, the intermediate sublayer comprising α and Cr, α being at least one of Fe, Ni, and Co, and the Cr content of the intermediate sublayer is lower than the Cr content of the upper sublayer.

52. An exchange coupled film according to Claim 26, further comprising an underlayer formed under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

53. An exchange coupled film according to Claim 26, wherein the seed layer is formed by sputtering.

54. An exchange coupled film according to Claim 26, wherein the average crystal grain size in a direction parallel to the layer surface in each layer formed on the seed layer is 100 Å or more.

55. An exchange coupled film according to Claim 54, wherein the average crystal grain size is 150 Å or more.

56. An exchange coupled film according to Claim 26, wherein the grain boundaries formed in the antiferromagnetic

layer and the grain boundaries formed in the ferromagnetic layer which appear in a cross section of the exchange coupled film parallel to the thickness direction are at least partially discontinuous at the interface between the antiferromagnetic layer and the ferromagnetic layer.

57. An exchange coupled film according to Claim 26, wherein the grain boundaries formed in the antiferromagnetic layer and the grain boundaries formed in the seed layer which appear in a cross section of the exchange coupled film parallel to the thickness direction are at least partially discontinuous at the interface between the antiferromagnetic layer and the seed layer.

58. An exchange coupled film according to Claim 26, wherein equivalent crystal planes represented as {111} planes in the antiferromagnetic layer and the ferromagnetic layer are preferentially oriented as crystal planes parallel to the interface between the antiferromagnetic layer and the ferromagnetic layer, and at least some of the equivalent crystal axes in the crystal planes are directed in different directions between the antiferromagnetic layer and the ferromagnetic layer.

59. An exchange coupled film according to Claim 26, wherein equivalent crystal planes represented as {111} planes in the antiferromagnetic layer and the seed layer are

preferentially oriented as crystal planes parallel to the interface between the antiferromagnetic layer and the seed layer, and at least some of the equivalent crystal axes in the crystal planes are directed in different directions between the antiferromagnetic layer and the seed layer.

60. An exchange coupled film according to Claim 26, wherein the antiferromagnetic layer comprises X and Mn, wherein X is at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, and Os.

61. An exchange coupled film according to Claim 26, wherein the antiferromagnetic layer comprises an X-Mn-X' alloy, wherein X is at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, and Os and X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Ir, Sn, Hf, Ta, W, Re, Au, Pb, and rare-earth elements.

62. An exchange coupled film according to Claim 61, wherein the X-Mn-X' alloy is either an interstitial solid solution in which atoms of X' enter interstices in a space lattice comprising X and Mn or a substitutional solid solution in which atoms of X' are substituted for some atoms at the lattice points of a crystal lattice comprising X and Mn.

63. An exchange coupled film according to Claim 60, wherein the X content is 45 to 60 atomic percent.

64. An exchange coupled film according to Claim 61, wherein the X + X' content is 45 to 60 atomic percent.

65. An exchange coupled film according to Claim 37, further comprising an underlayer formed under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

66. An exchange coupled film according to Claim 37, wherein the seed layer is formed by sputtering.

67. An exchange coupled film according to Claim 37, wherein the average crystal grain size in a direction parallel to the layer surface in each layer formed on the seed layer is 100 Å or more.

68. An exchange coupled film according to Claim 67, wherein the average crystal grain size is 150 Å or more.

69. An exchange coupled film according to Claim 37, wherein the grain boundaries formed in the antiferromagnetic layer and the grain boundaries formed in the ferromagnetic layer which appear in a cross section of the exchange

coupled film parallel to the thickness direction are at least partially discontinuous at the interface between the antiferromagnetic layer and the ferromagnetic layer.

70. An exchange coupled film according to Claim 37, wherein the grain boundaries formed in the antiferromagnetic layer and the grain boundaries formed in the seed layer which appear in a cross section of the exchange coupled film parallel to the thickness direction are at least partially discontinuous at the interface between the antiferromagnetic layer and the seed layer.

71. An exchange coupled film according to Claim 37, wherein equivalent crystal planes represented as {111} planes in the antiferromagnetic layer and the ferromagnetic layer are preferentially oriented as crystal planes parallel to the interface between the antiferromagnetic layer and the ferromagnetic layer, and at least some of the equivalent crystal axes in the crystal planes are directed in different directions between the antiferromagnetic layer and the ferromagnetic layer.

72. An exchange coupled film according to Claim 37, wherein equivalent crystal planes represented as {111} planes in the antiferromagnetic layer and the seed layer are preferentially oriented as crystal planes parallel to the interface between the antiferromagnetic layer and the seed

layer, and at least some of the equivalent crystal axes in the crystal planes are directed in different directions between the antiferromagnetic layer and the seed layer.

73. An exchange coupled film according to Claim 37, wherein the antiferromagnetic layer comprises X and Mn, wherein X is at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, and Os.

74. An exchange coupled film according to Claim 37, wherein the antiferromagnetic layer comprises an X-Mn-X' alloy, wherein X is at least one element selected from the group consisting of Pt, Pd, Ir, Rh, Ru, and Os and X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Ir, Sn, Hf, Ta, W, Re, Au, Pb, and rare-earth elements.

75. An exchange coupled film according to Claim 74, wherein the X-Mn-X' alloy is either an interstitial solid solution in which atoms of X' enter interstices in a space lattice comprising X and Mn or a substitutional solid solution in which atoms of X' are substituted for some atoms at the lattice points of a crystal lattice comprising X and Mn.

76. An exchange coupled film according to Claim 73,

wherein the X content is 45 to 60 atomic percent.

77. An exchange coupled film according to Claim 74, wherein the X + X' content is 45 to 60 atomic percent.